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09/241,851	02/02/1999	TAKEHIKO NAKAI	865.4335	9228

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EXAMINER	
CHANG, AUDREY Y	
ART UNIT	PAPER NUMBER
2872	

DATE MAILED: 04/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/241,851	NAKAI, TAKEHIKO
	Examiner	Art Unit
	Audrey Y. Chang	2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 August 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4,5,9 and 12-27* is/are pending in the application.

4a) Of the above claim(s) *25 and 26* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2, 4,5, 9 and 12-24 and 27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Remark

- This Office Action is in response to applicant's amendment filed on August 26, 2004, which has been entered into file.
- By this amendment, the applicant has newly added claims 23-27.

Election/Restrictions

1. This application contains claims directed to the following patentably distinct species of the claimed invention:

(A) Diffractive optical element having a pair of gratings having a constant pitch, (Figures 5, 6, and 9),

(B) Diffractive optical element having a pair of gratings circularly arranged with decreasing pitch, (Figures 11 and 13) (as in newly added claims 25-26).

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, no claims are generic.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

2. Newly submitted **claims 25-26** are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: claims 25-26 recite a diffractive optical element having a pair of diffraction gratings wherein the diffraction gratings are *circularly* arranged and have the *pitch* of the diffractive grating *decreases* in a direction from the center toward the margins of the circular arrangement.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, **claims 25-26 are withdrawn** from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

3. Claims 1-2, 4-5, 9, 12-24 and 27 remain pending in this application.

Claim Objections

4. Claims 23-24 are objected to because of the following informalities:

(1). The symbols "nd" and "vd" recited in claim 23 are not defined which therefore makes the meanings of the symbols and the scopes of the claims unclear.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 12, 13-17, 20-22 and newly added claim 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Ishii (PN. 6,157, 488) in view of the patent issued to Gerritsen et al (PN. 5,048,925).

Ishii teaches a ***diffractive optical element*** that is comprised of a *diffractive portion* having a *pair of diffractive gratings* (11 and 13, Figure 6, 14 and 16, Figure 7, or 101 and 103 Figure 8), wherein the pair of diffractive gratings are made of *materials* with *different dispersion properties*, (please see explicitly for the grating materials recited in column 13 lines 36-42). Ishii teaches that the pair of diffractive gratings each has a *thickness* of d1 and d2, wherein the *thickness* can be *different*. Ishii teaches explicitly that the *ratio of the grating thickness* is measured by α wherein it can assume both value one and not equal to one, (please see column 9, lines 35 and 60-67). In Figure 11, Ishii specifically teaches that the pair of diffractive gratings can be designed to have different thickness (d1 and d2) and the pair of diffractive gratings achieves maximum diffraction efficiency of a diffraction order (m=1) for *a range of wavelengths* that certainly include two or more wavelengths. This suggests by the *diffraction theory* the maximum path length difference is an *integer* multiple of more than two wavelengths in the range for the same integer or the same diffraction order. This means that the maximum path length difference determines if the diffractive optical element would diffract light having particular wavelengths at certain diffraction order. If the diffraction efficiency is at 100% for a diffraction order of certain wavelength, the maximum path length difference is equal to the diffraction order times the wavelength.

This reference has met all the limitations of the claims. Ishii also teaches that the pair of diffractive gratings is formed to confront each other with a *spacer* layer (12, 15 or 102) in between. However this reference does not teach explicitly that the spacer layer has a refractive index of 1. But using air (refractive index equals one) as spacer layer for separating a pair of diffractive gratings is rather well known in the art. **Gerritsen** et al in the same field of endeavor teaches to use an air gap as the spacer layer interposed between a pair of diffractive gratings. It would have been obvious to one skilled in the art to apply the teachings of Gerritsen et al to use air gap layer as an alternative material for making the diffractive optical element for the benefit of providing an alternative design for the element. It also has been held it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended used as a matter of obvious design choice. In re Leshin, 125 USPQ 416. Furthermore, it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

With regard to claim 12, Ishii teaches that the diffractive gratings have blaze type relief patterns.

With regard to claim 13, Ishii teaches that the diffractive optical element (41) may be used with a lens (51) within an image pick-up system (60), (please see Figure 22).

With regard to claims 15-16, Ishii teaches that the optical regions may include optical material such as ultraviolet curable resin, (please see column 13, line 40). Although this reference does not teach explicitly that each pair of the diffractive gratings are made of such resin however it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended used as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

With regard to claims 20-22, Ishii teaches the diffractive optical element is a diffractive lens that may assume conventional lens form (Figure 30) which means the diffractive optical element is formed on a lens.

With regard to newly added claim 27, Ishii teaches that the diffractive optical element (41) may be utilized in an optical system that is comprised of a diaphragm that is defined by the imaging lens (51) at the object side of the diffractive optical element, (please see Figure 22).

7. **Claims 2, 4, 5, 9, and 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patents issued to Ishii and Gerritsen et al in view of the patent issued to Sakai et al.**

Ishii teaches a *diffractive optical element* that is comprised of a *diffractive portion* having a *pair of diffractive gratings* (11 and 13, Figure 6, 14 and 16, Figure 7, or 101 and 103 Figure 8), wherein the pair of diffractive gratings are made of materials with *different dispersion properties*, (please see explicitly for the grating materials recited in column 13 lines 36-42). Ishii teaches that the pair of diffractive gratings each has a *thickness* of d1 and d2, wherein the thickness can be different. Ishii teaches explicitly that the *ratio* of the grating thickness is measured by α wherein it can assume both value one and not equal to one, (please see column 9, line 35 and 60-67). In Figure 11, Ishii specifically teaches that the pair of diffractive gratings can be designed to have different thickness (d1 and d2) and the pair of diffractive gratings achieves *maximum* diffraction efficiency for certain diffraction order (m=1) at *a range of wavelengths* that certainly include two or more wavelengths. This suggests by the diffraction theory the *maximum* path length difference is an integer multiple of more than two wavelengths in that range for the same integer or the same diffraction order. This means that the maximum path length difference determines if the diffractive optical element would diffract light having particular wavelengths at certain diffraction order. If the diffraction efficiency is at 100% for a diffraction order of certain wavelength, the maximum path length difference is equal to the diffraction order times the wavelength.

This reference has met all the limitations of the claims. Ishii also teaches that the pair of diffractive gratings are formed to confront each other with a spacer layer (12, 15 or 102) in between. However this reference does not teach explicitly that the spacer layer has a refractive index of 1. But

using air as spacer layer for separating a pair of diffractive gratings are rather well known in the art. **Gerritsen** et al in the same field of endeavor teaches to use an air gap as the spacer layer that interposed between a pair of refractive gratings. It would then have been obvious to one skilled in the art to apply the teachings of Gerritsen et al to use air layer as an alternative material for making the diffractive optical element for the benefit of providing an alternative design for the element. It also has been held it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended used as a matter of obvious design choice. In re Leshin, 125 USPQ 416. Furthermore, it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

These references however do not teach explicitly that the peak portions and/or the valley portions of the pair of diffractive gratings are formed in a *chamfered shape*. **Sakai** et al in the same field of endeavor teaches a diffractive grating element with the *peak portion* and the *valley portion* of the grating being made of *chamfered shapes* such that it has *flat land region* (M) for the peak portion and *curved* or *tilted* angle (20) for the valley portion, (please see Figures 3(a) and 3(b)). Sakai et al teaches that by adjusting the size of the chamfered shapes, the pitch of the diffractive grating may be changed so that diffraction efficiency may be changed. It would then have been obvious to one skilled in the art to apply the teachings of Sakai et al to modify the diffractive optical element of Ishii to make the gratings have chamfered shapes for the peaks and/or valley portions for the benefit of changing the pitch of the gratings therefore changing the diffraction efficiency.

With regard to claim 13, Ishii teaches that the diffractive optical element (41) may be used with a lens (51) within an image pick-up system (60), (please see Figure 22).

With regard to claims 15-16, Ishii teaches that the optical regions may include optical material such as ultraviolet curable resin, (please see column 13, line 40). Although this reference does not teach explicitly that each pair of the diffractive gratings are made of such resin however it has been held to be

within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended used as a matter of obvious design choice. In re Leshin, 125 USPQ 416.

With regard to claims 18 and 19, Sakai et al teaches explicitly that the region forming the chamfered shape is each formed with a flat surface (M) and a curved surface (20, Figure 3a). Although this reference does not teach explicitly about the claimed sizes for the chamfered regions however these modifications would have been obvious to one skilled in the art, for it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

8. Newly added claims 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Ishii (PN. 6,157, 488) in view of the patent issued to Gerritsen et al (PN. 5,048,925) and applicant admitted prior art.

Ishii teaches a ***diffractive optical element*** that is comprised of a *diffractive portion* having a *pair of diffractive gratings* (11 and 13, Figure 6, 14 and 16, Figure 7, or 101 and 103 Figure 8), wherein the pair of diffractive gratings are made of *materials* with *different dispersion properties*, (please see explicitly for the grating materials recited in column 13 lines 36-42). Ishii teaches that the pair of diffractive gratings each has a *thickness* of d1 and d2, wherein the *thickness* can be *different*. Ishii teaches explicitly that the *ratio of the grating thickness* is measured by α wherein it can assume both value one and not equal to one, (please see column 9, lines 35 and 60-67). In Figure 11, Ishii specifically teaches that the pair of diffractive gratings can be designed to have different thickness (d1 and d2) and the pair of diffractive gratings achieves maximum diffraction efficiency of a diffraction order (m=1) for *a range of wavelengths* that certainly include two or more wavelengths. This suggests by the *diffraction theory* the maximum path length difference is an *integer* multiple of more than two wavelengths in the range for the same integer or the same diffraction order. This means that the maximum path length difference

determines if the diffractive optical element would diffract light having particular wavelengths at certain diffraction order. If the diffraction efficiency is at 100% for a diffraction order of certain wavelength, the maximum path length difference is equal to the diffraction order times the wavelength.

This reference has met all the limitations of the claims. Ishii also teaches that the pair of diffractive gratings is formed to confront each other with a *spacer* layer (12, 15 or 102) in between. However this reference does not teach explicitly that the spacer layer has a refractive index of 1. But using air (refractive index equals one) as spacer layer for separating a pair of diffractive gratings is rather well known in the art. **Gerritsen** et al in the same field of endeavor teaches to use an air gap as the spacer layer interposed between a pair of diffractive gratings. It would have been obvious to one skilled in the art to apply the teachings of Gerritsen et al to use air gap layer as an alternative material for making the diffractive optical element for the benefit of providing an alternative design for the element. It also has been held it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended used as a matter of obvious design choice. In re Leshin, 125 USPQ 416. Furthermore, it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

With regard to the feature concerning the diffraction gratings to have the specific "nd" and "vd" values, *these values are not defined* which makes the scopes of the claim unclear since it is not clear what are these values for. These features can therefore only be examined with broadest interpretations as they are referred to *refractive index* and *Abbe's number of the materials* respectively. Ishii teaches that the diffraction gratings can be made of plastic materials with certain refractive indices and dispersion values known as Abbe's numbers, (please see column 13). This reference however does not teach explicitly to use the materials having the specific refractive indices and Abbe's numbers as claimed. However Ishii does give a *general* teachings for the conditions to make the diffractive optical element as *functions* of the

refractive indices and Abbe's numbers of the materials used. **Applicant's admitted prior art** also teaches that the resin materials with the specific refractive indices and the Abbe's numbers are very well known materials in the art to make diffractive optical element, (please see page 6 of the specification). It would then have been obvious to one skilled in the art to use the specific materials with the specific refractive indices and the Abbe's numbers *with the conditions* set by Ishii to make the diffractive optical element for the benefit of making the diffractive optical element with the specific design that fit the specific requirement. Furthermore, it also has been held it is within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended used as a matter of obvious design choice. In re Leshin, 125 USPQ 416. Furthermore, it has been held when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

With regard to claim 24, these references do not teach explicitly that the pitch of the gratings is of the cited value. However the pitch of a grating is a fundamental factor for determining the diffraction characteristics of the grating and based on the diffraction equation it is a function of the wavelength of the light designed to be diffracted, (i.e. they are interrelated). It would then have been obvious to one skilled in the art to modify the diffractive optical element of Ishii to make the grating has this pitch for the benefit of making the element to be able to diffract particularly desired wavelength.

Response to Arguments

9. Applicant's arguments filed August 16, 2004 have been fully considered but they are not persuasive. The newly added claims have been fully considered and they are rejected for the reasons stated above.

In response to applicant's arguments, which state that if the spacer layer of the diffractive optical element recited in *Ishii* reference being an air layer with refractive index of one, the "required combination set

forth in Ishii would be *impossible* to form", the examiner respectfully disagrees for the reasons stated below. Firstly, the applicant **fails** to provide scientific reasons for such assertion. Secondly, the examiner wishes to state the contrary that by making the refractive index being one for the spacer layer, all of the equations recited by Ishii will still hold. In particularly, Ishii teaches the step height for each of the grating when the grating layer is interfaced with an air layer, (please see column 2). Thirdly, Ishii teaches general design formula for the diffractive optical element with pair of the diffraction gratings it is within general level of skill of a worker in the art to use the equation to find the desirable materials and combination to form the diffractive optical element as desired. Since it has been held to be within the general skill of a worker in the art to **select** a **known material** on the basis of its **suitability** for the intended used as a matter of obvious design choice. In re Leshin, 125 USPQ 416. Furthermore, it has been held when the **general conditions** of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Audrey Y. Chang
Primary Examiner
Art Unit 2872

A. Chang, Ph.D.